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Production Efficiency of Farmers under National Fadama II Project in Oyo State, Nigeria

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Abstract

The study examines production efficiency of farmers under National Fadama-II Project in Oyo State Nigeria. Primary data were collected from two hundred and sixty-four farmers using multistage sampling technique. The analytical framework used for the study include: descriptive, infrastructure index, gross margin and stochastic frontier production function. Average infrastructural index in the area was 0.42. The gross margin for IDV was ₦445, 968.30 while for IUV for under-developed in Fadama villages is ₦357, 805.00. Gross margin was higher for Fadama II farmers than non Fadama-II farmers in IDV. The mean technical efficiency were 0.69 and 0.59 for Fadama and non-Fadama farmers respectively. The result showed that technical inefficiency of female Fadama-II farmers reduced by 0.19% while that of non-Fadama II farmers by 1.23%. Similarly, extension contact, marital status and infrastructural status reduced technical inefficiency of Fadama-II farmers by 2.8%, 0.3% and 2.6% respectively. Presence of infrastructure of Fadama-II project has imparted on efficiency of resource use among the beneficiary. There is therefore need to improve on Community Driven Development programme like Fadama-II and on coming Fadama-III project or any developmental project, so as to further impart more technical and economic knowledge to farmers.

Keywords:
Rural infrastructure, Infrastructural Index, Gross margin, Agricultural production, Technical inefficiency

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INTRODUCTION

Nigeria is a food-deficit country that on many occasions has been dependent on food imports (Adeoye, 2010). Its agricultural sector has ceased to be an important contributor to foreign exchange earnings; even its contribution to employment has declined. According to Ojo and Akanji (1996), the growth index of agricultural production for crops has shown a decline from 7.4 percent in 1986 to 3.4 percent in 1995. Most studies show that aggregate food production in Nigeria has been growing at about 2.5 percent in recent years, but the annual rate of population growth has been at 3.5 percent (Ajibefun and Abdulkadir, 1999). This situation has not always been so and in fact; there is a great national optimism that the current predicament would be reversed and Nigeria return to full status of a major food basket in the region.

Successive governments in Nigeria have studied the decline in agriculture and have attempted various efforts to re-activate the sector. They include National Agricultural Land development Authority (1991-1999); Presidential Initiatives on cocoa, cassava, rice, livestock, fisheries and vegetables (1999 - 2007) and Poverty Alleviation Programs. Most such efforts have been frustrated by inadequate attention to the critical social and economic root causes of the decline. For instance part of the plight of the traditional Nigerian farmers, which constitute the bulwark of its agricultural landscape, has been the loss of income resulting from wastage and spoilage due to poor infrastructure base. This has been disincentive to the traditional farmers and therefore has been discouraged from extending his acreage. Furthermore, what was a poor infrastructure based deterred the transfer/transportation of farm produce to the urban centers where better prices could be attained. Limited potentials of traditional preservation and processing methods are formidable constraints to increase output.

Consequently development economists have not focused on infrastructure as much as they have on directly productive activities such as agriculture and industry. Also in the course of conducting research on food policies and agriculture in general, it has increasingly been recognized that development of infrastructure, particularly rural infrastructure, bears enormous implications for policy outcome (IFPRI, 2008). Underlying the trend of poor performance in the agricultural sector, is the problem that the farming systems are upland subsistence agriculture that depend mainly on vagaries of weather while the potentials for irrigation using underground and surface water remain underdeveloped. In Nigeria, various agricultural programs and policies have been instituted in the past, and were meant to improve sustainable productivity and farmers' income, consequently the quality of lives of the rural households. One of such projects is the National Fadama (Fadama is a Hausa word for low-lying flood plains, usually with easily accessible shallow groundwater) Development Project II. However, despite the beneficial goals of the project in phases, some communities are yet to participate and benefit from the services offered in the study area. This is because they lack the required basic infrastructures, reducing their production efficiencies and capacities to meet market demands.

In 2001 a New Agricultural Policy and the Integrated Rural Development Policy were initiated to ensure national food security, attain self-sufficiency in basic food production, enhance employment opportunities and achieve high growth rate for the economy. In order to fast track the gains of the 2001 New Agricultural Policy, there came the Presidential Initiatives in Agriculture (PIA) in 2004 and the National Special Food Security Program (NSFSP) and FADAMA II in 2005. The PIA gave priority to four different crop-based expansions of production and utilisation programs (e.g. cassava, rice, tree crops and vegetable oil) and livestock and fisheries programme with a view to curtail the huge foreign exchange expended in their importation and their importance in the revival of industries based on their raw materials. However, FADAMA II are targeted at the resource poor rural farmers and aimed at raising their agricultural productivity and production to eliminate their poverty and through them attain food security. The inadequacy in the provision of rural infrastructure, lack of maintenance culture coupled with inconsistency in policies regarding infrastructural development is expected to have a negative impact on agriculture, which is the major occupation in the rural areas and main sustenance of development in Nigeria. In this regards, it becomes pertinent to know how effectively Fadama II project has solved this problem of rural infrastructural development. This study therefore, attempts to examine production efficiency of farmers under National Fadama II Project in Oyo State Nigeria.

Theoretical Framework and Literature Review

Infrastructural investments in transport (roads, railways and civil aviation), power, irrigation, watersheds, hydroelectric works, scientific research and training, markets and warehousing, communications and informatics, education, health and family welfare play a strategic but indirect role in the development process. Unlike sectoral development, say agriculture or industry, infrastructure does not directly increase output, but makes a significant contribution towards growth by increasing the factor productivity of land, labour and capital in the production process.

Theoretically, economists proceed from the premise that the creation of infrastructure by generating external economies leads to widespread benefits. For example; Figure 1, shows how traditional theory conceptualizes the effect of infrastructural development on production for a competitive market economy. In a situation of inadequately developed infrastructure, firms are confronted with higher marginal cost (MC_1) at every level of production, and, given the market price of their output, produce at Q_1. with an improvement in infrastructure, the marginal cost curve shifts downward to the right (MC_2), resulting in a total cost savings of area abcd for the earlier level of output, Q_1, and an increase in output from Q_1 to Q_2. The cost reduction occurs through the interaction of infrastructure with directly productive inputs of firms/farms thereby increasing efficiency of production. This may, however, come in a variety of ways, such as reduction in transfer costs, improved diffusion of technology, new combinations of inputs and outputs, better input prices, increased specialization and commercialization, and improved entrepreneurial capacity, all realized through infrastructural investment. The cost reduction is the outcome of an interaction between directly productive inputs of other firms.

MC_1= Marginal Cost with infrastructure deficiencies

MC_2=Marginal Cost with adequate infrastructure

According to Idachaba and Olayide (1980), rural infrastructures constituted the substance of rural welfare, which is the improvement of the socio-economic life of a community. Idachaba and Olayide (1980) observed that a realistic national development programme should be able to cater for a majority of the nation's populace, which according to him, is formed in the rural areas in less developed countries. However, World Bank (2002) asserted that the provision of social amenities in the rural areas could help in the achievement of an increased rural production and income. Also, Ekong (2000) explains that the spread of needed infrastructure and introduction of appropriate technology in rural areas would markedly improved rural agriculture and industrial output. There is a consensus among authors in terms of general objectives of infrastructural development in rural areas that is the improvement of the standard of living of the rural poor and their integration into the life of the nation.

Peng (2002) who pointed out that road construction could reduce the expenditure of agricultural production while Fang and Zhang (2004) revealed that the potential of agricultural production can be release through rural infrastructure investment.

A recent study by Zongang Li and Xiaomin Liu (2009) on the effect of rural infrastructural development on agricultural production technical efficiency using data from Second Agricultural Census of China indicated that telecommunication, road, good water supply, conducting vocational/technical education and electricity were all positively associated with agricultural production technical efficiency expect telecommunication. These studies demonstrate that investment in infrastructures is essential to increase farmers' access to input and output markets, to stimulate the rural non-farm economy and vitalize rural towns, to increase consumer demand in rural areas, and to facilitate the integration of less-favoured rural areas into national and international economies.

MATERIALS AND METHODES

The Study Area: The study was carried out in Oyo State one of the states selected for Fadama II project in the south western geo political zone, Nigeria. It is bounded in the west by Benin Republic, in the south by Ogun State, in the east by Osun State and in the north by Kwara State. According to the 2006 Census, Oyo State population stood at 5,591,589. Oyo State has thirty-three Local Government Areas (LGAs) in which only 10 participated in Second National Fadama project.

Agriculture is the major source of income for the greatest number of people of the State. Apart from the primary roles of providing food and shelter, employment, industrial raw materials, it remains an important source of internally generated revenue in the State. The state has distinct wet and dry seasons, which characterize its humid tropical climate, with the dry season extending from November to March. Annual rainfall varies from about 500 mm in the northern belt to 1,100 mm in the forest belt. The climate favours the growth of food crops like yam, cassava, millet, maize, fruits, rice and plantains. Cash crops such as cocoa, citrus, tobacco and timber also abound in the state.

Source of data and sampling procedure: Primary data were collected for the purpose of this study using structured questionnaire. Some of these include: socio economic and demographic characteristics, Infrastructure proxy variable (such as distance of getting to various infrastructure such as road, market facilities, processing equipment and the access to sanitation etc.) and total production inputs and output quantities and their respective prices of Fadama and non-Fadama crop farmers. A multi-stage stratified random sampling procedure was adopted for the study. The stratification sampling procedure helped in avoiding selection bias that could arise from comparison between participating and non-participating Fadama II project LGAs. The sampling frame was stratified into two strata: Beneficiaries' local government areas and Non -beneficiaries' local government areas (LGAs) that have some social economic and biophysical characteristics comparable to the beneficiaries' LGAs. The first stage of selection involved random selection of two LGAs out of ten that participated in Fadama II project and two LGAs from the remaining twenty-three local government areas that are non participants. In the next stage, 17 villages were randomly selected from each of these LGAs. The last stage involved selection of four farmers from each village. In all, a total of 160 farmers/respondents were chosen in each stratum (given total of 320 farmers/respondents for Fadama II and non-Fadama farmers). A total of 320 respondents were interviewed while two hundred and sixty four questionnaires were retrieved for analysis.

Analytical tools: The analytical techniques in the data analysis include: descriptive statistics, infrastructure index, gross margin and stochastic frontier production function.

Descriptive statistics: Descriptive statistics (mean, frequency table, percentages).

Composite measure of infrastructure development (Infrastructure Index): The infrastructural index used for this study is based on the sampled village level data adopted from Fakayode *et al.*, (2008) and comparable to method developed by Sen (1990). A total cost of access (TC) was computed by summing the individual cost of access (TCi) to the some six basic infrastructure elements in the study area. These six are those provided by Fadama II project. These infrastructure elements/facilities include market, motorable road, potable borehole, box Culvert, VIP toilet and processing unit.

A total cost of infrastructure availability (TC) was computed by summing the average cost (ACi) of getting a particular infrastructural facility in the 68 villages. ACi was however obtained as an average individual transportation cost was (IDci) of the respondents in each of the 68 villages. For instance, a village may be located 2 kilometers from processing unit center and yet access to the center may be difficult than for a village located 5 kilometers away, if the latter has a better transport system, which is normally reflected in the transportation cost.

An Average Total Cost (ATC) of getting to each of the six infrastructure elements across the villages was obtained by dividing the total cost (TC) by the total number of village (N). ACi was finally weighted with ATC to obtain the weight Wi for each infrastructure and across all the villages. The infrastructure index (INF) was finally obtained by finding the average of the Wis of the six infrastructural facilities for each of the 68 villages.

Algebraically:

$$ACi = \frac{\sum_{i=1}^{n} IDi}{n} \quad \ldots\ldots (1)$$

$$TC = \sum_{i=1}^{N} ACi \quad \ldots\ldots (2)$$

$$ATC = \frac{TC}{N} \quad \ldots\ldots (3)$$

$$Wi = \frac{ACi}{ATC} \quad \ldots\ldots (4)$$

$$INF = \sum_{1}^{6}(Wi.TCi \sum_{1}^{6} Wi \quad \ldots\ldots (5)$$

Where:

ID_{ci} = Individual transportation cost of getting to each Infrastructure by the respondents in each village

AC_i = Average cost of transportation in each village.

TCi = Total cost of transportation to a particular infrastructure i across villages.

ATC=Average total cost of transportation across villages.

Wi = Weight of Average transportation cost in each village.

INF = Infrastructural Index

N = Total number of villages.

M = Total number of infrastructure facilities.

n = Number of respondents in each village.

The infrastructural Index (INF) indicates the degree of under-development, thus, the higher the value of the INF, the less developed the village considered. Further approach to grouping the villages into developed and underdeveloped areas was to sum the infrastructural index for all the 68 villages and the average obtained. The villages with value above the average were said to be under-developed and those below average were said to be developed.

Gross Margin Analysis: The gross margin of an enterprise is the difference between the total value of production and the variable cost. In this study, the gross margin/farmer in the developed and underdeveloped areas for both Fadama and non-Fadama farmers were estimated and compared to determine the profitability of their enterprises.

Gross Margin can be expressed mathematically as;

GM= TR – TVC...................................... (6)

Where:

GM= Gross Margin/farmer (₦)

TR= Total Revenue (₦)

TVC= Total Variable Cost (₦)

TVC includes the cost of: Land area (ha), Labour (man-days), Chemical, Seeds and fertilizer, Land clearing etc

TR includes the cost of all sales in the production

T-test analysis: T-test analysis was used for the testing of hypothesis that rural infrastructure has a significant effect on agricultural production between the beneficiaries and non-beneficiaries or otherwise.

$$t = \frac{\bar{x} - \mu}{\frac{\sigma}{\sqrt{n}}}$$

Where $\bar{x}$ is the sample mean x_1, x_2 …. x_n taken from a normal distribution of μ and σ^2. σ^2 is an estimate of σ n is sample size. μ is the mean while σ is the estimated variance.

Test of Difference between Means

Test of difference between means was employed to determine whether the difference in the profit made by Fadama II beneficiary and non –beneficiary farmers in the developed and underdeveloped areas was significantly different from zero. The null hypothesis stated as; there is no significant difference in the average profit of Fadama II beneficiary and non–beneficiary farmers in the developed and underdeveloped areas is given by;

$$H_O: \ XP \neq XNP$$

Where:

$$XP = \frac{\sum \Pi P}{nP} \quad \text{and} \quad XNP = \frac{\sum \Pi NP}{nNP}$$

The relationship for the test of difference between means is given by:

$$Z_{score} = \frac{XP - XNP}{S(XP - XNP)}$$

Where the standard error; S(XP – XNP) is given by:

$$\frac{\sqrt{S2P}}{NP} + \frac{S2NP}{NNP}$$

XP = Average profit of Fadama II participated farmers

XNP = Average profit Non-fadama participated farmers

SP and SNP = Standard deviations of XP and XNP

Stochastic Frontier Production Model: The stochastic frontier production function was used to determine the effect of rural infrastructure on the crops farmer's efficiency of beneficiaries and non-beneficiaries communities. The stochastic frontier developed by Battese and Coelli (1995) was used to estimate the MLE equation. The Stochastic Frontier model production function is defined by:

$Y1 = F(X1, \beta) \exp(Vi-Ui)$………………….(7)

where i = 1, 2,-------------N, where V_i is a random error.

Yi = output or dependent variable (grain equivalent)

Xi = Vector of inputs or independent variable

β = the regression coefficient

Ui = the stochastic error term

Therefore, Cobb-douglas production function in the stochastic frontier form, the model can be expressed thus:

$Yi = \beta 1\ X2^{\beta 2}\ X3^{\beta 3}\ X4^{\beta 4}\ X5^{\beta 5}\ X6^{\beta 6}\ X7^{\beta 7}\ e^{ui}$…… (8)

Where:

Y = Output (grain equivalent)

X_1= Farm size (ha)

X_2= Labour (man day)

X_3= Seeds (kg)

X_4 = fertilizer (kg)

X_1 to X_4 are productive variables

U = is the stochastic disturbance

However, if this mode is Log-linearised, the new equation is obtained as thus:

$LnY_i = Lnb_o + b_iLnX_i \ldots\ldots + b_nl_nX_n + (V_i - U_i)$…(9)

Where bo = constant term

$(V_i - U_i)$ Stochastic error term

V_i = symmetric error

U_i = inefficiency

$b_i - b_n$ = production coefficient of the variables

Inefficiency model

The inefficiency model can be stated as:

$|Ui| = \theta_o + \alpha i \sum Mi + di$

Where

$|Ui|$ = inefficiency of ith farmer

M_1 to M_5 are technical variables

M_1 = sex of the farmer (Male=1, 0 otherwise)

M_2 = age (years)

M_3 = Education level of the farmer (years)

M_4 = assess to extension facilities (weekly)

M_5 = Participation in Fadama II project

M_6 = infrastructural index

d_i = error term

RESULTS

Table 1 presents the distribution of respondents by marital status. The bulk of the respondents (87.1%) are married regardless of the category of respondents (81.1% for Fadama and 98.8% for non-Fadama farmers). The implication of this is that, there is likely to be more family labour available for farm work. However, majority of respondent farmers (Fadama and non-Fadama) farmers are older than 50 years. This is the active age when farmers can carry out the physical rigor of farm activities. This has implication for agricultural production because farm work requires physical energy and strength.

Education status shows that the largest percentage of the respondents (83.3%) had primary education and more. Education has an important implication particularly for the adoption of new technology and practice (Akinbile and Ndaghu,

Table 1: Socio-economic characteristics of the respondents

Variable	Fadama	Non -Fadama	All
Marital status			
Single	1.7	1.1	1.5
Married	81.1	98.8	87.1
Widowed	12.1	-	8.0
Divorced	5.2	-	3.4
Total	**100.0**	**100.0**	**100.0**
Age			
< 30	1.7	1.1	1.5
30-50	62.6	50.0	58.3
51-70	35.6	48.9	40.2
Total	**100.0**	**100.0**	**100.0**
Educational level			
No Formal	20.7	8.9	16.7
Primary	39.1	65.6	48.1
Secondary	29.9	24.4	28.0
Tertiary	10.3	1.1	7.2
Total	**100.0**	**100.0**	**100.0**
Household size			
1-5	16.1	2.2	11.4
6-10	73.0	84.4	76.9
11-15	8.6	13.3	10.2
> 15	2.3	-	1.5
Total	**100.0**	**100.0**	**100.0**
Gender			
Male	69.0	88.9	75.8
Female	31.0	11.1	24.2
Total	**100.0**	**100.0**	**100.0**
Membership of organization			
Members	66.7	46.7	59.8
Non members	33.3	53.3	40.2
Total	**100.0**	**100.0**	**100.0**
Farm size(ha)			
< 1.00	8.0	7.8	8.0
1.00-2.00	66.7	60.0	64.4
2,00- 4.00	21.8	31.1	25.0
> 4.00	3.4	1.1	2.7
Total	**100.0**	**100.0**	**100.0**
Farming experience			
<10	42.5	20.0	34.8
11-12	36.8	38.9	37.5
21-30	17.2	36.7	23.6
> 30	3.4	4.4	3.8
Total	**100.0**	**100.0**	**100.0**
Employment status			
Full time	55.20	80.0	63.6
Part time	44.80	20.0	24.4
Total	**100.0**	**100.0**	**100.0**

Table 2: Average amount spent on market in the study area

Status	≤ ₦ 40	₦41- ₦ 60	₦ 61-. ₦ 80	≥ ₦ 80	Average
Fadama	₦ 8.42	₦52.00	₦ 74.29	₦133.5	₦44.44
	0.55km	27 km	3.36 km	24.25km	22.27km
	0 mins	0.82mins	19.23 min	61.25min	27.02min
Non-fadama	₦20.86	₦53.57	₦80.00	₦100.00	₦55.23
	1.47 km	3.00km	3.00km	4.71km	2.56km
	0.16 min	6.67 min	NA	16.67min	7.03min
All	₦ 12.97	₦52.65	₦74.69	₦126.80	₦32.39
	1.1 km	2.24 km	2.0 km	2.66 km	1.50km
	3.53 min	20.58min	22.01min	27.60min	9.05min
Average amount spent on motorable roads					
Status	≤ ₦ 40	₦ 41- ₦ 60	₦ 61-. ₦ 80	≥ ₦ 80	Average
Fadama	₦ 11.91	₦50.00	₦72.00	₦138.24	₦28.58
	1.11 km	1.50 km	2.80 km	4.94 km	4.25 km
	2.10 mins	7.50 mins	19.00 mins	12.94 mins	4.25 mins
Non-fadama	₦14.05	₦50.00	NA	₦185.00	₦34.02
	0.92 km	2.00 km	NA	3.10 km	1.18km
	0.0.45 mins	7.50 mins	NA	18.50mins	2.61 mins
All	₦ 12.67	₦ 50.00	₦ 72.00	₦ 155.56	₦ 30.38
	1.04 km	1.67 km	2.80 km	4.26km	0.45 km
	0.26 mins	7.50 mins	19.00 mins	21.67 mins	3.63 mins
Average amount spent on water					
Status	≤ ₦ 40	₦ 41- ₦ 60	₦ 61-. ₦ 80	≥ ₦ 80	Average
Fadama	Na	NA	NA	NA	NA
	1.12km	NA	NA	NA	NA
	NA	NA	NA	NA	NA
Non-fadama	Na		NA	NA	
	NA	NA	NA	NA	NA
	NA	NA	NA	NA	NA
All					
	NA	NA	NA	NA	NA
	NA	NA	NA	NA	NA
	NA	NA	NA	NA	NA
Average amount spent on possessing unit in the study area					
Status	≤ ₦ 40	≤ ₦ 40	₦ 61-. ₦ 80	≥ ₦ 80	Average
Fadama	₦ 8.42	₦ 8.42	₦ 74.29	₦133.5	₦44.44
	0.55km	0.55km	3.36 km	24.25km	22.27km
	0 mins	0 mins	19.23 min	61.25min	27.02min
Non-fadama	₦20.86	₦20.86	₦80.00	₦100.00	₦55.23
	1.47 km	1.47 km	3.00km	4.71km	2.56km
	0.16 min	0.16 min	NA	16.67min	7.03min
All	₦ 12.97	₦ 12.97	₦74.69	₦126.80	₦32.39
	1.1 km	1.1 km	2.0 km	2.66 km	1.50km
	3.53 min	3.53 min	22.01min	27.60min	9.05min

Source: Field Survey (March 2009)
Note: NA – NOT AVAILABLE, ₦150.00 =$1.00

2000). In all, most of the households have at least 6 members which is higher than the national average for all respondents (Fadama and non-Fadama). The national average household size is 5 (NBS, 2007). The size of the household is an importance variable especially in a situation where human power is a major source of power for carrying out farming activities. Notwithstanding Fadama respondents shows a relatively higher percentage of women participation in the farming activities than men. This was attributed to their participation in Fadama I project, a project that gave equal chances to both man and woman and with the provision of some incentives such as market expansion and rehabilitation/construction of rural roads that links to the city, which particularly motivate women to agricultural activities. The implications of more women participation in farming activities increases the population in the agricultural production, thereby reduces food prices, by making food available and improves the standard of living (Nkonya *et al.,* 2008). The result further shows that majority of respondents/farmers belonged to organization. Membership of associations is common among Fadama II more than non-Fadama farmers. Belonging to farmers' organization enable respondents/farmers to have access to information, cheaper inputs, extension services, profitable and other intangible benefits that enhance efficiency in production.

The distribution of the respondent's farm size shows that average farm size for the entire groups was 2 hectares and most farmers have farming experience of at least 10 years while majority of respondents/farmers are full time farmers.

Table 2 shows that infrastructure facilities in the study are those related to agriculture available in both Fadama and non-Fadama areas. These include: Market, motorable road, Boreholes, VIP toilet, Box culvert and processing services center.

Fadama farmers spent an average of ₦44.44 and 27.02 minutes respectively to access market infrastructure provided by the project in beneficiary communities while in non-beneficiary communities spent more on the average to access the same facility. The infrastructure facilities in the study are those related to agriculture available in both Fadama and non-Fadama areas. These include: Market, motorable road, Boreholes, VIP toilet, Box culvert and processing services center. The study revealed that Government and Non-Governmental agents provided available infrastructure facilities in non- Fadama areas. Fadama farmers spent an average of ₦44.44 and 27.02 minutes respectively to access market infrastructure provided by the project in beneficiary communities while in non-beneficiary communities spent more on the average to access the same facility. It shows that Fadama farmers spent the least average amount to various infrastructure elements. Thus the distance barrier is reduced, as transport cost is at minimal in Fadama participating LGAs. Thereby, Fadama participating villages had better access to various infrastructural facilities provided and they were found to be significantly better off in a number of areas including agricultural production, household incomes, and health. The findings support Bhatia and Rai (2008), that the measure of access to various infrastructures is the physical distance in kilometers or transport cost between the households and the centers where these services are provided.

Table 3 shows the average length of time individuals wait for motor vehicle. It was observed that average waiting time for Fadama LGAs is lower compare to non-Fadama LGAs at 10.44 minute, compared with Fadama LGAs of 5.70 minutes. Across LGAs it is 6.80 minutes. In

Table 3: Average time taken to wait for motor vehicle transport

Status	Average waiting time (minute)	Standard deviation (minute)
Fadama	5.70	4.5462
Non – Fadama	10.44	4.8452
All	6.80	5.0182

Source: Field Survey (March 2009)

Table 4: Distribution of villages by degree of infrastructure development

Range of index number	Number of villages			Percentages			Ranking level
	Fadama	Non-Fadama	All	Fadama	Non-Fadama	All	
≤0.10	20	3	23	29.41	4.41	32.35	Highly developed
0.11-0.3	13	8	21	19.12	11.76	32.35	Moderately developed
0.31-0.5	9	12	21	13.24	17.64	30.88	Moderately under-de-
≥0.51	2	1	3	2.94	1.47	4.41	veloped
Total	44	24	68	64.71	35.28	100	Highly under-developed

Source: Field Survey (March 2009)

Table 5: Gross margin analysis

	Developed (naira)		Under-developed (naira)	
Variable inputs	**Fadama**	**Non-fadama**	**Fadama**	**Non-fadama**
Cost of labour	49481.0	41350.10	31464.00	22000.00
Cost of fertilizer	17148.00	25850.50	13660.00	34640.30
Cost of planting mats	7103.70	17801.20	11056.00	19650.00
Cost of land clearing	26869.00	50,000.00	30455.00	67500.00
Total variable cost	100,601.70	135,001.80	86,635.00	143,790.30
Total revenue	546,570.00	499,150.00	4.44,440.00	486,360.00
Gross Margin	445,968.30	364,148.20	357,805.00	342,569.70

Source: Field Survey (March 2009)

order to have a vivid exposition of the degree of under-development, index of infrastructure in Table 4 shows that the index of infrastructure ranges between 0.04 and 0.53 for all the LGAs with an average of 0.17, 0.24 and 0.42 for Fadama, non-Fadama and the entire 68 villages respectively. It further reveals that Fadama villages were more highly infrastructural developed compared with non-Fadama villages.

Cost structure and Gross margin were analyzed and compared to isolate the effect of rural infrastructural development on the profitability of Fadama beneficiaries and non –beneficiaries in developed and underdeveloped areas In Fadama LGAs, cost of labours is higher in developed villages than in the underdeveloped villages and for all other variable input, except for the Cost of land clearing. Total variable cost is however higher in the developed villages than in the underdeveloped villages. Despite the higher total variable cost in the developed villages, gross margin was higher in the developed villages than in the underdeveloped villages. Table 5 shows that the total variable cost was estimated at ₦100,601.70 in the developed villages and ₦86635.00 in the underdeveloped villages while the gross margin was estimated in Fadama community to be ₦ 445, 968.30 in the developed villages and ₦ 357,805.00 in the underdeveloped villages. On the other hand, all variable factors cost is lower in the developed villages except for the cost of labour under non-Fadama LGAs. Thus, total variable cost is however higher in the underdeveloped villages than in the developed villages. This might be as a result of poor road that make market accessibility difficult and at the time increases the cost of procuring inputs. Despite the higher total revenue in both developed and the underdeveloped villages, gross margin/farmer was lower because of the higher total variable cost in both developed and the underdeveloped when comparing villages. Table 5 further shows that the total variable cost was estimated at ₦135, 001.80 in the developed villages and ₦143, 790.30 in the underdeveloped villages while the gross margin was estimated in Non-Fadama community to be ₦364,148.20 in the developed villages and ₦ 342,569.70 in the underdeveloped villages. This result therefore, shows a higher return for Fadama participants in both developed and underdeveloped villages than the non-Fadama, a

Table 6: Test of Difference between means

Status	Mean gross margin (₦)	Mean Difference (₦)	T -value	Prob.
Fadama	88,163.3	66584.8	3.216	0.000
Developed	445,968.30			
Underdeveloped	357,805.00			
Non-fadama	21,578.50			
Developed	364,148.20			
Underdeveloped	342,569.70			

Source: Field Survey (March 2009)

result, which must have been made possible by the presence of infrastructure provided by Fadama II project. Test of difference between the gross margins of Fadama beneficiaries and non–beneficiaries is shown in Table 6. Result shows that there is significant different in the gross margins of Fadama beneficiary and non–beneficiary farmers at 1% and the gross margins for Fadama beneficiaries are higher than that of the non–beneficiary.

The result of efficiency score among the farmers in Table 7 shows that the mean technical efficiency of 0.693, 0.588, and 0.681 for Fadama, non-Fadama and the entire respondents respectively. The two groups of famers are operating some distance from the frontier with fadama technical efficiency. 68% of the Fadama farmers have technical efficiency above 0.84 while more that two-thirds of the Fadama farmers are operating not too far from the frontier. About 22.2% and 43.2% of the farmers have technical efficiency exceeding 0.84 for non-Fadama and the entire respondents respectively.

Table 8 shows the result of technical inefficiency of Fadama farmers. The result showed that farm size significantly leads to technical inefficiency whereas labour leads to reduced technical inefficiency at 1% level of significance. The implication is that increase in investment on labour in farming activities tends to give higher productivity and enhance the technical efficiency. In the case of seed input used, the estimate was also positive and significant, implying that as quantity of seed sown increases, crop yield increases for the Fadama II farmers. However, the coefficient of infrastructure index was negative. This implies that, as the level of infrastructural development in an area increases, technical inefficiency of farmer's increase. This result agrees with (Bhatia *et al.,* 2004 and Wanmali, 1985) who reported that the farther the services from the households, the less they were used. In case of extension contact, the variable was negative and significant at 1%. It indicates that the involvement of extension agent tends to reduce the technical inefficiency for crops production. This agrees with Olayide (1985) that development of infrastructure and extension work is a precondition for the adoption and diffusion of new agricultural technology.

Also, the coefficients of educational level and years of experience were negative and these factors led to decrease in technical inefficiency of farmers. This agrees with the findings of Ojo and Ajibefun (2000) that education and year of experience increase the rate of adoption of im-

Table 7: Summary of technical efficiency of farmers

Interval	Percentages		
	Fadama	Non- Fadama	All
0.04 – 0.23	5.70	4.44	3.78
0.24 – 0.43	12.07	23.33	13.67
044 – 0.63	20.11	33.33	21.59
0.64 –0.83	22.99	16.67	17.80
0.84-1.03	68.2	22.20	43.1

Source: Field Survey (March 2009)

Table 8: Estimation of the technical efficiency of farmers

Variables	CoefficientCoefficient		
	Fadama	**Non- Fadama**	**All**
Constant	6.348 (11.28)***	8.930 (47.77)	7.564 (9.03***)
Farm Size	-0.494 (-4.40)***	0.321 (1.10)	0.0136 (0.10)
Labour	0.534 (13.32)***_	-8.280 (-0.21)	0.588 (3.18)***
Chemical	0.750 (0.39)	0.026 (0.21)	0.133 (0.48)
Seeds	0.128 (2.56)	0.139 (1.81*)	0.166 (2.23)**
Equipment	-0.0749 (-0.64)		0.159 (0.65)
Inefficiency function			
Constant	1.636 (1.00)	-1.348 (-1.37)	0.713 (-0.09)
Age	-0.833 (-1.22)	0.565 (2.17)**	-0.779 (0.39)
Gender	-0.190 (-2.19)**	-1.226 (-1.81)*	-1.0920 (-1.30)
Marital Status	-0.273 (-2.89)***		0.255 (0.24)
Educational Level	-.0.395 (-1.06)	1.747 (1.67)*	0.346 (0.79)
Extension Contact	-2.803 (-2.86)***		3.335 (1.91)*
Infrastructure status	-2.644 9 (-2.09)**	-0.259 (0.94)	3.761 (-1.78)*
Fadama Status dummy	0.378 (0.72)	0.259 (0.94)	0.836 (0.99)
Years of Experience	-1.268 (-1.54)	1.137 (3.90)***	0.590 (1.28)
Member of an organization			0.325 (0.45)
Sigma-Square	7.769 (5.56)	2.865 (7.29)***	20.0504 (2.84)***
Gamma	0.9999 (1530819.9)	0.999(869317.01)***	0.976 (91.18)***

Source: Field Survey (March 2009) t- ratios are in parentheses, Log likelihood function = -0.307
*** Significant at 1 percent, ** Significant at 5 percent, * Significant at 10 percent
*** P < 0/01 **P < 0/05 *P < 0/1

proved production. The result also shows that the coefficients age and gender of farmers were negative; implying that older farmers have higher technical inefficiency than younger farmers and farming activities is labour intensive with gender bias.

Infrastructural index are significant at 5% while extension contact and marital status were significant at 1%. For non-Fadana farmers, the result on the impact of socio-economic variables on technical inefficiency reveals that the coefficient of gender was negative at 10%. The implication is that being female decreases inefficiency among the farmers. In other hand, the result further shows that educational level and years of experience were negative and significantly explained inefficiency of the fadama farmers. The shows that additional year of education and experience of the farmers decreased inefficiency in fadama farmers whereas for the non fadama farmers it increased their inefficiency. Years of participation in Fadama farmers is negatively related to technical inefficiency. This implies a decreased level of technical inefficiency

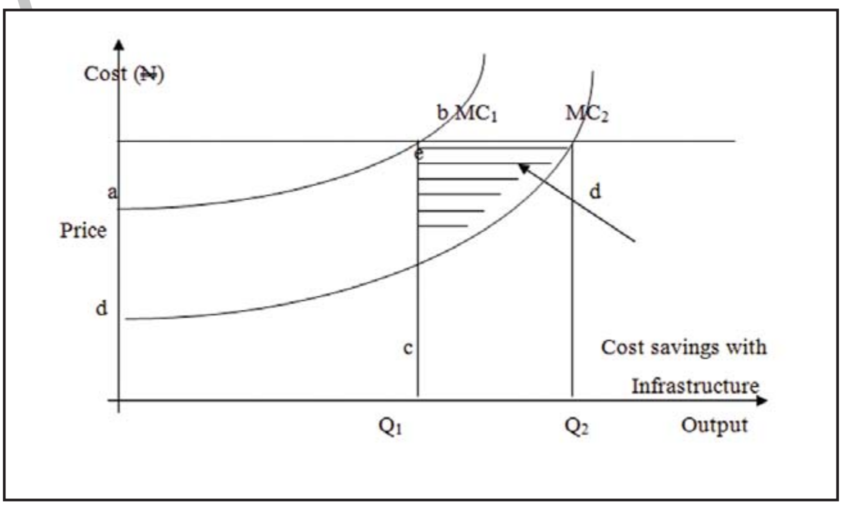

Figure 1: Infrastructure Provision and Efficiency of Production

as the farmers spend more years in the programme. The likely reason for this is that the farmer may develop more skill with time as long as they are in the scheme. This finding supports Muhammad-Lawal, *et al.*, (2009) that more skill will be acquired as long as the farmer remains in the program. Infrastructure index was not significant meaning it did not contribute to inefficiency of the farmers.

CONCLUSIONS AND RECOMMENDATIONS

The efficiency of production is enhanced by high level of infrastructural development. Though infrastructure is seen as an indirect capital input, it is essential for improving farmers' production efficiency. In order to improve on the level of efficiency of farmers, improved infrastructural development is a sine qua.

Presence of infrastructure has implications for efficiency of resource use. Fadama participating villages had better access to various infrastructural facilities provided and they were found to be significantly better off in a number of areas including agricultural production, household income and also the participation of women in the economy also they obtain higher price for produce and to buy a larger proportion of consumption needs from the market when compare to non-Fadama participating villages. Thus development of infrastructure has a positive effect/impact on the wholesome lives of the people in the areas. Therefore more infrastructural facilities should be provided to aids development most especially in non-Fadama area.

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REFERENCES

1- Adeoye, A. (2010). Impact of Rural Infrastructural Development on Agricultural Production under Fadama II project in Oyo State. Unpublished M.Sc thesis, University of Ibadan.

2- Akinbile, L. A., and Ndaghu A. A. T. (2000). Poverty Level and Poverty Alleviation Strategies of Farm Families Michika L.G.A of Adamawa State, Nigeria. Journal of Economics and Rural Development, 14 (2), 101-109.

3- Ajibefun, I. A., and Abdulkadri, A. (1999). An Investigation of Technical Inefficiency of Production of Farmers under the National Directorate of Employment in Ondo State, Nigeria. APP Economics Letters, 6, 111-114.

4- Battese, G. E., and Coelli. T.J. (1995). A Model for Technical Inefficiency Effects in a Stochastic Frontier Production Function. Empirical Economics, 20: 325-32.

5- Bhatia, V. K and Rai, S. C. (2008). Evaluation of Socio- Economic Development in Small Areas, A project Report on Indian society of agricultural statistics Iasri Campus, Library Avenue, Pusa New Delhi - 110 012 (2003 – 2004)

6- Fakayode, B. S., Omotheso, O. A., Isoho, A. B., and Ajayi P. D. (2008). An Economic Survey of Rural Infractructures and Agricultural Productivity Profiles in Nigeria European. Journal of Social Science, 7, (2): 158-170.

7- Fan, S., and Zhang, X. (2004). Infrastructure and Regional Economic Development in Rural China. China Economic Review, (15): 203-214.

8-Idachaba, F. S. and Olayide, S.O. (1980). Rural Infrastructure and the Small Farmers. Pp. 245- 256 in S.O. Olayide *et al,.* (editors), Nigerian Small Farmers: Problems and Prospects in Integrated Rural Development, Ibadan, C.A.R.D., University, Ibadan.

9- Muhammad-Lawal, A., Omotesho, O.A., and Falola, A. (2009). Technical Efficiency of Youth Participation in Agriculture: A Case Study of The Youth - In Agriculture Programme in Ondo State, South Western Nigeria Nigerian Journal of Agriculture, Food and Environment, 5(1): 20-26.

10-NBS (2007) National Bureau of Statistic Abuja Nigeria

11- Nkonya E., Phillip, D., Mogues, T ., Yahaya, M. K., Pender, J., Adebowale, G., Arokoyo, T., and Kato, E. (2008). The Impact of a Pro-Poor Community Driven Development Project in Nigeria. International Food Policy Reseach Institute (IFPRI)

12- Ojo, M. O. and Akanji, O. O. (1996 June). The Impact of Macroeconomic Policy Reforms on Nigeria Agriculture. CBN Economic and Financial Review. 34 (2): 549-579.

13- Peng, D. (2002). Rural Infrastructure Investment and Poverty Reduction, Jingji Xuejia (The Economist) (5): 79-82.

14-Wanmali, S. (1985). Rural Household Use of Services. A Study of Miryalguda Taluka India. Research Report 48. Washington, D.C. IFPRI.

15- World Bank. (2002). Inadequate Infrastructural

Facilities as a Measure of Poverty, World Bank Economic and Social Studies Review. 44 (1).
16- Zonghang, L., and Liu, X. (2009). The effects of Rural Infrastructure Development on Agricultural Production Technical Efficiency; Evidence from the Data of Second National Agricultural Census of China. Paper presented at the International Association of Agricultural Economists Conference, Beijing, China.